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(54) Abstract Title
Cold Box

(57) A cold box (1) comprises a cryogenic assembly (2), an outer jacket (3), and at least one thermal insulator (4) filled in between the cryogenic assembly and the outer jacket. The outer jacket comprises a main part (20) globally surrounding the main cryogenic assembly (6) from a distance, and at least one localised auxiliary part (21) projecting laterally outwards from the main part, and surrounding at least one protruding auxiliary cryogenic element (16, 19) from a distance. The invention is particularly applicable to air distillation installations. Insulator 4 is preferably perlite and is subjected to atmospheric pressure. Cold box 1 may be prefabricated before being assembled around assembly 2.

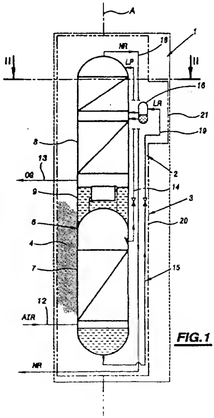

FIG. 1

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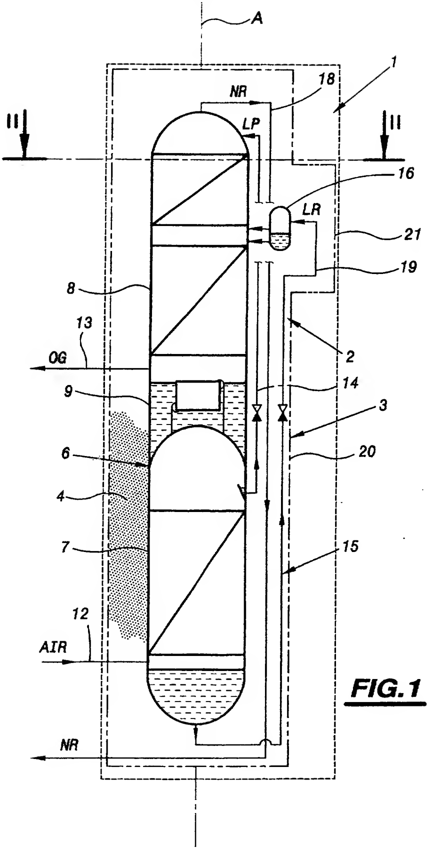
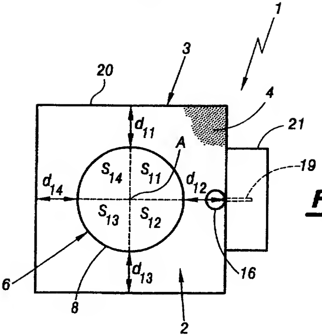


FIG.1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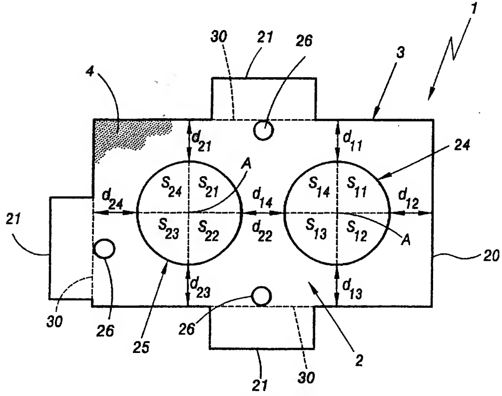
3
20
4
21
d_{11}
A
S_{14}
S_{11}
d_{12}
19
d_{14}
S_{13}
S_{12}
16
6
d_{13}
8
2

FIG.2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30
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26
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d_{21}
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S_{24}
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d_{12}
21
S_{23}
S_{22}
d_{22}
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26
25
26
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21
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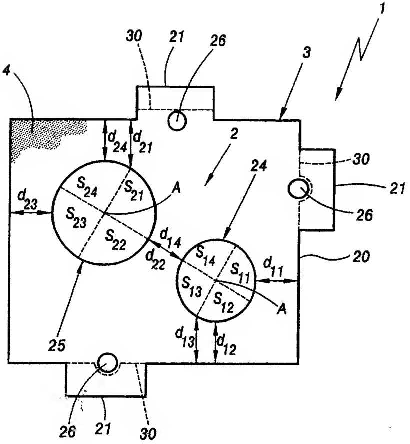
FIG.3


1
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d_{14}
d_{22}
d_{11}
d_{13}
d_{12}
S_{24}
S_{21}
S_{23}
S_{22}
S_{14}
S_{11}
S_{13}
S_{12}

FIG.4

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The present invention relates to a cold box of the type comprising:

- a cryogenic assembly comprising nmain cryogenic element(s) and some auxiliary cryogenic elements, each main cryogenic element being selected from the group consisting of cryogenic columns, sections of such columns, heat exchangers and superposed combinations thereof,

- an outer jacket surrounding the cryogenic assembly from a distance,

- at least one thermal insulator filled inbetween the cryogenic assembly and the outer jacket,

- a main part globally surrounding the, or at least most of the, main cryogenic element(s) from a distance, and

- at least one localized auxiliary part, projecting laterally outwards from the main part and surrounding at least one protruding auxiliary cryogenic element from a distance.

The invention applies, for example, to air distillation installations.

Such installations comprise distillation columns operating at very low temperatures. In order to restrict heat exchanges with the outside, the cryogenic assembly formed by such a column and its equipment items is surrounded with a thermal insulator, such as perlite or glass-wool or rock-wool. This thermal insulator is held in place by an outer jacket or cladding which surrounds the cryogenic assembly from a distance and which is supported by an interior or exterior framework. The assembly thus formed is generally known as a cold box.

The external dimensions of a cold box depend on those of the cryogenic assembly which it contains and on the minimum thickness of insulator needed to provide satisfactory thermal insulation.

The external dimensions of a cold box have a direct influence on its overall cost of construction, for example through the amount of thermal insulator

used, the surface area of the outer jacket, the size of the frameworks needed to support the outer jacket, and also because these dimensions may be too great to allow the prefabricated cold box to be transported on site.

Now, it is desirable to get as much of the construction of a cold box done at the workshop as possible before the box is installed on site, in order to control manufacturing deadlines, meet quality requirements, and limit the cost incurred by work performed on the installation site, as such a site may, for example, be subject to arduous climatic conditions.

One object of the invention is therefore to solve this problem by providing a cold box of the aforementioned type, the external dimensions of which are small.

To this end, the subject of the invention is a cold box of the aforementioned type, characterized in that each protruding auxiliary cryogenic element is selected from the group consisting of separator pots, reservoirs, connecting pipework, portions of such pipework and apparatuses for monitoring and controlling the operation of the cryogenic assembly.

According to particular embodiments, the cold box may comprise one or other of the following features, taken in isolation or in any technically feasible combination:

- each main cryogenic element is selected from the group consisting of distillation and/or mixing columns, sections of such columns, heat exchangers and superposed combinations thereof,

- each thermal insulator is subjected essentially to atmospheric pressure and the main part of the outer jacket is dimensioned in such a way that, if each main cryogenic element is denoted i with i = 1, ..., n, there are four angular sectors (S_{11}, S_{12}, S_{13}, S_{14}, S_{21}, S_{22}, S_{23}, S_{24}) which are complementary and roughly equal and centred on the longitudinal axis (A) of the element considered and which are such that, if the minimum transverse distances between, on the one

hand, the element considered and, on the other hand, the outer jacket and if the other main cryogenic element(s) arranged beside the element considered are denoted d_{ij} respectively, with j = 1, ..., 4 for the four sectors considered, then

$$\sum_{i=1}^{n}\sum_{j=1}^{4} d_{ij} \leq 2.7 \times \underline{n} \text{ (in metres)}$$

- the main part of the outer jacket is dimensioned in such a way that

$$\sum_{i=1}^{n}\sum_{j=1}^{4} d_{ij} \leq 2.5 \times \underline{n} \text{ (in metres)}$$

- the main part of the outer jacket is dimensioned in such a way that

$$\sum_{i=1}^{n}\sum_{j=1}^{4} d_{ij} \leq 2.3 \times \underline{n} \text{ (in metres)}$$

- the main part of the outer jacket is dimensioned in such a way that

$$\sum_{i=1}^{n}\sum_{j=1}^{4} d_{ij} \leq 2 \times \underline{n} \text{ (in metres)}$$

- the main part of the outer jacket is dimensioned in such a way that

$$\sum_{i=1}^{n}\sum_{j=1}^{4} d_{ij} \leq 1.7 \times \underline{n} \text{ (in metres)}$$

- at least one thermal insulator is perlite,

- at least one main cryogenic element has a transverse dimension in excess of 0.4 m,

- the said main cryogenic element has a transverse dimension in excess of 1 m.

Another subject of the invention is an air distillation installation, characterized in that it comprises a cold box as defined hereinabove.

A further subject of the invention is a method for the on-site construction of a cold box as defined hereinabove, characterized in that:

- the cold box is prefabricated in the form of a packet comprising roughly the entire cryogenic assembly and the main part of the outer jacket, some auxiliary parts thereof being at least partially missing,

- the packet is transported,
- the cryogenic assembly is completed as necessary,
- the outer jacket is completed using its at least partially missing auxiliary parts, and
- each thermal insulator is filled in between the outer jacket and the cryogenic assembly.

According to an alternative form, before transporting the packet, the outer jacket is fitted with blanking panels at the location of the at least partially missing auxiliary parts, and these blanking panels are removed after transport and before the outer jacket is completed using its at least partially missing auxiliary parts.

The invention will be better understood from reading the description which will follow, which is given solely by way of example and made with reference to the appended drawings in which:

- Figure 1 is a diagrammatic side view of a cold box according to the invention,
- Figure 2 is a diagrammatic view in section on the line II-II of Figure 1, and
- Figures 3 and 4 are views similar to Figure 2 illustrating other cold boxes according to the invention.

It will be noted that the relative dimensions of the various elements have not been observed in Figures 1 to 4, for reasons of clarity.

Figure 1 illustrates a cold box 1 which forms part of an air distillation installation. The cold box 1 is arranged vertically on the site of the air distillation installation.

This cold box 1 comprises an inner cryogenic assembly 2, an outer jacket 3 (in chain line in Figure 1) and a thermal insulator 4, for example perlite, filled in between the assembly 2 and the jacket 3 and essentially subjected to atmospheric pressure. Only part of the thermal insulator 4 has been depicted in the figures. In real life, this practically

entirely fills the space delimited between the assembly 2 and the outer jacket 3. In alternative forms, a number of thermal insulators 4 may be used simultaneously.

The cold box 1 also comprises, in the conventional way, a framework arranged outside the jacket to support it.

This framework has not been depicted in the figures in order not to overfill them.

The cryogenic assembly 2 is a conventional assembly which comprises a main cryogenic element 6 and some auxiliary cryogenic elements.

The main cryogenic element 6 is a double air distillation column which itself in the conventional way comprises a medium-pressure column 7, a low-pressure column 8 and a vaporizer-condenser 9 for the exchange of heat between the nitrogen from the top of the medium-pressure column 7 and the oxygen from the bottom of the low-pressure column 8.

Of the auxiliary cryogenic elements, only those which follow have been depicted, in order not to overfill the figures:

- a pipe 12 introducing air that is to be distilled, previously compressed, purified and cooled by a main heat-exchange line, not depicted,

- a pipe 13 for tapping gaseous oxygen off the bottom of the low-pressure column 8, this gaseous oxygen being intended to heat up in the main heat exchange line,

- a pipe 14, equipped with an expansion valve, for returning «lean liquid» LP (almost pure nitrogen) from the top of the medium-pressure column 7 to the top of the low-pressure column 8,

- a pipe 15, also fitted with an expansion valve, for tapping «rich liquid» LR (oxygen-enriched air) from the bottom of the medium-pressure column 7,

- a separator pot 16 for separating the «rich liquid» into a stream of liquid and a stream of gas,

and for returning these two streams separately to an intermediate level of the low-pressure column 8, and

- a pipe 18 for removing impure or «residual» nitrogen NR drawn from the top of the low-pressure column 8, to return it to the main heat exchange line.

The separator pot 16 and the downstream section 19 of the pipe 15 connected to it, form a local lateral protrusion of the cryogenic assembly 2 with respect to the double column 6.

As illustrated by Figures 1 and 2, the outer jacket 3 comprises a main part 20 and an auxiliary part 21.

The main part 20 has a cylindrical shape with a square base and a vertical axis coincident with the axis A of the double column 6. The main part 20 surrounds the double column 6 in such a way that the four side faces of the main part 20 are located at distances d_{11}, d_{12}, d_{13} and d_{14} from the double column 6, which distances are equal to about 0.5 of a metre.

These distances d_{11}, d_{12}, d_{13} and d_{14} correspond to the minimum transverse distances between the double column 6 and the main part 20 of the outer jacket 3 for four angular sectors S_{11}, S_{12}, S_{13} and S_{14} which are complementary, roughly equal and centred on the axis A. These sectors each therefore correspond to an angle of about 90°.

We therefore have approximately $d_{11} + d_{12} + d_{13} + d_{14} = 2$ m.

According to an alternative, d_{11}, d_{12}, d_{13}, d_{14} are equal to about 0.4 of a metre, which means that their sum is about 1.6 m.

In addition, the main part 20 of the outer jacket 3 surrounds the pipes 14, 15 and 18 over most of their lengths from a distance which is far enough to satisfactorily thermally insulate them. This insulation distance depends in fact on the capacity and nature of the cryogenic assembly 2 which in particular influence the dimensions of the pipes 14, 15 and 18. Thus, in the

case of a double distillation column with a diameter of about 2 m, this distance may be about 300 mm.

The auxiliary part 21 of the outer jacket 3 is a local protrusion of parallelepipedal shape formed on a side face of the main part 20 facing the separator pot 16. This local protrusion, projecting laterally outwards from the main part 20, surrounds the separator pot 16 and the downstream section 19 of the pipe 15 from sufficient distances to satisfactorily thermally insulate them. As before, these insulation distances depend on the method employed by the cryogenic assembly 2.

For example, the insulation distance for the separator pot 16 may be about 0.5 m and the insulation distance for the section 19 may be about 300 mm.

The dimensions of the outer jacket 3 are therefore such that a sufficient thickness of perlite 4 surrounds the cryogenic assembly 2 so that the latter operates satisfactorily.

In addition, the external dimensions of the jacket 3 are smaller by comparison with those of a conventional parallelepipedal outer jacket dimensioned to globally surround the entire cryogenic assembly 2, as depicted in dotted line in Figure 1. This is because, in this case, the cold box would have been completely dimensioned to provide satisfactory thermal insulation for the protruding auxiliary cryogenic elements 16 and 19. By contrast, in the cold box 1 according to the invention, the greatest lateral dimensions of the cold box are present only in the region of the auxiliary part 21 of the outer jacket 3, the main part 20 having been dimensioned without taking account of the thickness of thermal insulation 4 needed for the separator pot 16 and the section 19 of the pipe 15.

The cold box 1 is therefore of limited external dimensions and therefore of reduced construction cost.

It will be noted that in Figures 1 and 2, the auxiliary part 21 has been depicted exaggeratedly big

by comparison with the main part 20. In practice, the auxiliary part 21 has, for example, a bulk of between about 1 and 10 m^3 whereas the main part 20 has, for example, a bulk of between about 25 and 400 m^3. For example, the height of an auxiliary part 21, as seen when the cold box 1 is installed vertically on site, is less than 7 m. The thickness of an auxiliary part 21 is typically in excess of 100 mm or preferably 300 mm.

What is more, the number of auxiliary parts 21 varies according to the cryogenic assemblies 2 and may be as high as several dozen.

In general, the auxiliary cryogenic elements that are to be surrounded by auxiliary parts 21 are selected from the group consisting of separator pots, reservoirs, connecting pipework, sections of such pipework, and apparatuses for monitoring and controlling the operation of the cryogenic assembly.

The reservoirs constituting protruding auxiliary cryogenic elements may have varying capacities and, for example, capacities between 3 and 25 m^3.

The heights of these auxiliary cryogenic elements, as seen when the cold box 1 is installed vertically on site, are, in particular, less than about 6 m.

According to some alternative forms which have not been depicted, an auxiliary part 21 of the jacket 3 may extend roughly over the entire height of the cold box 1 or over the entire periphery thereof.

In the latter instance, the auxiliary part 21 may be located at the lower end of the cold box 1 which therefore has a widened base. The base and the remainder of the cold box 1 may then be prefabricated at the workshop in the form of two packets which are transported and then assembled on site.

Figure 3 illustrates another cold box 1 according to the invention, in which the cryogenic assembly 2 comprises two main cryogenic elements 24 and 25 which are arranged one beside the other and which

may, for example, be sections of a double distillation column. Thus, the section 24 may be a medium-pressure column surmounted by a vaporizer-condenser and the section 25 may be a low-pressure column.

The cryogenic assembly 2 also comprises auxiliary cryogenic elements, just three protruding elements of which have been depicted, and which bear the reference 26.

The main part 20 of the outer jacket 3 has a vertical cylindrical shape on a rectangular base, which globally surrounds the main cryogenic elements 24 and 25.

In the case of the first cryogenic element 24, the minimum distances between this element 24 and the three neighbouring side faces of the main part 20 of the outer jacket 3 and the second main cryogenic element 25 are denoted d_{11}, d_{12}, d_{13} and d_{14}.

These distances d_{11}, d_{12}, d_{13} and d_{14} correspond to the minimum transverse distances between the main cryogenic element 24 and the main part 20 of the outer jacket 3 or the other main cryogenic element 25 for four angular sectors S_{11}, S_{12}, S_{13} and S_{14} which are complementary, roughly equal and centred on the vertical axis A of the element 24. These sectors therefore each correspond to an angle of about 90°.

In the case of the second cryogenic element 25, the distances between this element 25 and the three neighbouring side faces of the main part 20 and the other main cryogenic element 24 are denoted d_{21}, d_{22}, d_{23} and d_{24}.

These distances d_{21}, d_{22}, d_{23} and d_{24} correspond to the minimum transverse distances between the main cryogenic element 25 and the main part 20 of the outer jacket 3 or the other main cryogenic element 24, for four angular sectors S_{21}, S_{22}, S_{23} and S_{24} which are complementary, roughly equal and centred on the vertical axis A of the element 25. These sectors therefore each correspond to an angle of about 90°.

The distances d_{11}, d_{12}, d_{13}, d_{14}, d_{21}, d_{22}, d_{23} and d_{24} are approximately equal to 0.5 of a metre. Thus, the sum of these distances is approximately equal to 4 metres.

The outer jacket 3 comprises three auxiliary parts 21 each of which surrounds an auxiliary cryogenic element 26 protruding with respect to the main cryogenic elements 24 and 25, so as to provide satisfactory thermal insulation of these elements 26.

In a similar way to the scenario of Figure 1, the use of local protrusions 21, provided on a main part 20 which globally surrounds the main cryogenic elements 24 and 25, makes it possible to limit the external dimensions of the cold box 1 while at the same time ensuring satisfactory thermal insulation of the entire cryogenic assembly 2.

More generally, this principle can be used for cold boxes comprising $\underline{n}$ main cryogenic element(s) with $n \geq 1$. The main cryogenic elements are selected from the group consisting of distillation and/or mixing columns, sections of such columns, heat exchangers and superposed combinations thereof.

Thus, the main part 20 of a cold box 1 can be dimensioned to globally surround a double air distillation column and the main heat exchange line which cools the air that is to be distilled.

Advantageously, the main part 20 of the outer jacket 3 is dimensioned in such a way that, if each main cryogenic element is denoted $\underline{i}$ with $i = 1, \ldots, \underline{n}$, there are four angular sectors which are complementary and roughly equal and centred on the longitudinal axis of the element considered and which are such that, if the minimum transverse distances between, on the one hand, the element considered and, on the other hand, the outer jacket and if the other main cryogenic element(s) arranged beside the element considered are denoted d_{ij} respectively, with $j = 1, \ldots, 4$ for the four sectors considered, then

$$\sum_{i=1}^{n}\sum_{j=1}^{4} d_{ij} \leq 2.7 \times \underline{n} \text{ (in metres)}$$

It is then found that the cold box obtained is very compact and affords the main cryogenic element good thermal insulation with respect to the outside.

More advantageously, and using the same notation as above,

$$\sum_{i=1}^{n}\sum_{j=1}^{4} d_{ij} \leq 2.5 \times \underline{n} \text{ (in metres)}$$

As a preference, adopting the same notation as above,

$$\sum_{i=1}^{n}\sum_{j=1}^{4} d_{ij} \leq 2.3 \times \underline{n} \text{ (in metres)}$$

More advantageously still,

$$\sum_{i=1}^{n}\sum_{j=1}^{4} d_{ij} \leq 2 \times \underline{n} \text{ (in metres)}$$

Finally, the best results are obtained when, using the previous notation,

$$\sum_{i=1}^{n}\sum_{j=1}^{4} d_{ij} \leq 1.7 \times \underline{n} \text{ (in metres)}$$

In the examples of Figures 1 to 3, the framework supporting the outer jacket 3 is arranged on the outside of this jacket. When elements of this framework are arranged inside the outer jacket 3, these elements are considered as forming part of the outer jacket, which means that the minimum distances d_{ij} are possibly measured between such elements and the main cryogenic element i.

Moreover, if the main part 20 of the outer jacket 3 has a non-constant cross section, the distances d_{ij} will be measured in the cross section that makes it possible to respect the dimensional constraints expressed above.

The cold box 1 of Figure 4 illustrates how the four sectors and the corresponding distances d_{ij} are chosen when the axes A of the main cryogenic elements are not contained in a plane parallel to one of the faces of the main part 20 of the outer jacket 3.

It will also be noted that, in order to apply the abovementioned mathematical formulae, the main cryogenic elements to be considered are only the main cryogenic elements arranged beside each other.

Thus, when two or more main cryogenic elements are arranged one above the other, that is to say superposed, as is the case in Figures 1 and 2, these main cryogenic elements are likened to a single main cryogenic element.

Of course, the principle set out hereinabove applies to outer jackets 3, the main part 20 of which has a cylindrical shape on a base other than a rectangular or square one, for example on a circular base.

The abovementioned dimensional constraints apply in particular to the main cryogenic elements with transverse dimensions, for example diameters, in excess of 1 m and preferably in excess of 0.4 m.

A preferred method for constructing cold boxes according to the invention will now be described with reference to Figure 3.

First of all, the cold box 1 is prefabricated at the workshop in the form of a packet comprising the cryogenic assembly 2, the main part 20 of the outer jacket 3 and the framework supporting the latter.

Just one auxiliary part 21 (at the top in Figure 4) of the outer jacket 3 is partially formed, the other parts not being formed.

Blanking panels 30 (in dotted line) are fitted in place of the missing auxiliary parts 21 and in place of the missing region of the partially formed part 21. In the case of the missing auxiliary parts 21, these panels 30 extend the corresponding side faces of the main part 20 of the outer jacket 3 and may, for example, be formed integrally with these side faces or attached to cover cutouts formed in these side faces at the future locations of the auxiliary parts 21.

The panel 30 used for the partially formed auxiliary part 21 is flat and presses against the

region formed of this part 21, while the other panels 30 have shapes which are tailored to the projecting regions of the corresponding protruding auxiliary cryogenic elements 26.

The packet thus produced is then transported onto site. The panels 30 allow the inside of the cold box 1 to be protected during this transportation.

Construction of the cold box 21 is then completed on site by removing the panels 30, fitting the missing auxiliary parts 21 and completing the partially formed auxiliary part 21 and filling the thermal insulator 4 into the outer jacket 3.

The prefabricated packet therefore has transverse dimensions smaller than those of the cold box 1 that is to be constructed.

This method therefore makes it possible, for given transportation gauge widths, for cold boxes with cryogenic assemblies of larger capacity to be prefabricated than was the case in the methods in which the prefabricated packet had the same dimensions as the cold box that was to be constructed.

Thus, the method of construction described therefore makes it possible to prefabricate, in the form of transportable packets, a wider range of cold boxes and therefore to reduce the cost of construction of these cold boxes.

When protruding cryogenic elements 26 project slightly with respect to the main part 20 of the outer jacket 3, the blanking panels 30 have an overall shape with a corresponding concave profile, as illustrated in Figure 4.

In an alternative, the prefabricated packet may be transported to near to the cold box installation site to complete the construction of this cold box. The cold box thus constructed is then transported as far as the actual installation site.

According to another alternative form which has not been depicted, auxiliary parts 21 may be just partially missing from the prefabricated packet.

The principles described hereinabove may of course be used to manufacture cold boxes containing cryogenic assemblies employing any kind of cryogenic method, particularly a method of distilling air or a gas from the air, and more generally a method treating a gas which can be distilled or liquefied by a cryogenic route.

CLAIMS

1. Cold box (1) of the type comprising:

- a cryogenic assembly (2) comprising n main cryogenic element(s) (6; 24, 25) and some auxiliary cryogenic elements (12 to 16, 18, 19; 26), each main cryogenic element being selected from the group consisting of cryogenic columns, sections of such columns, heat exchangers and superposed combinations thereof,

- an outer jacket (3) surrounding the cryogenic assembly from a distance,

- at least one thermal insulator (4) filled in between the cryogenic assembly and the outer jacket, the outer jacket comprising:

- a main part (20) globally surrounding the, or at least most of the, main cryogenic element(s) from a distance, and

- at least one localized auxiliary part (21), projecting laterally outwards from the main part and surrounding at least one protruding auxiliary cryogenic element (16, 19; 26) from a distance,

characterized in that each protruding auxiliary cryogenic element is selected from the group consisting of separator pots, reservoirs, connecting pipework, portions of such pipework, apparatuses for monitoring and controlling the operation of the cryogenic assembly.

2. Cold box according to Claim 1, characterized in that each main cryogenic element is selected from the group consisting of distillation and/or mixing columns, sections of such columns, heat exchangers and superposed combinations thereof.

3. Cold box according to either one of Claims 1 and 2, characterized in that each thermal insulator (4) is subjected essentially to atmospheric pressure and in that the main part (20) of the outer jacket (3) is dimensioned in such a way that, if each main cryogenic element (6; 24, 25) is denoted <u>i</u> with i = 1, ..., <u>n</u>, there are four angular sectors (S_{11}, S_{12}, S_{13}, S_{14}, S_{21},

S_{22}, S_{23}, S_{24}) which are complementary and roughly equal and centred on the longitudinal axis (A) of the element considered and which are such that, if the minimum transverse distances between, on the one hand, the element considered and, on the other hand, the outer jacket and if the other main cryogenic element(s) arranged beside the element considered are denoted d_{ij} respectively, with j = 1, ..., 4 for the four sectors considered, then

$$\sum_{i=1}^{n}\sum_{j=1}^{4} d_{ij} \leq 2.7 \times \underline{n} \text{ (in metres)}$$

4. Cold box according to Claim 3, characterized in that the main part (20) of the outer jacket is dimensioned in such a way that

$$\sum_{i=1}^{n}\sum_{j=1}^{4} d_{ij} \leq 2.5 \times \underline{n} \text{ (in metres)}$$

5. Cold box according to Claim 4, characterized in that the main part (20) of the outer jacket is dimensioned in such a way that

$$\sum_{i=1}^{n}\sum_{j=1}^{4} d_{ij} \leq 2.3 \times \underline{n} \text{ (in metres)}$$

6. Cold box according to Claim 5, characterized in that the main part (20) of the outer jacket is dimensioned in such a way that

$$\sum_{i=1}^{n}\sum_{j=1}^{4} d_{ij} \leq 2 \times \underline{n} \text{ (in metres)}$$

7. Cold box according to Claim 6, characterized in that the main part (20) of the outer jacket is dimensioned in such a way that

$$\sum_{i=1}^{n}\sum_{j=1}^{4} d_{ij} \leq 1.7 \times \underline{n} \text{ (in metres)}$$

8. Cold box according to any one of Claims 1 to 7, characterized in that at least one thermal insulator (4) is perlite.

9. Cold box according to any one of Claims 1 to 8, characterized in that at least one main cryogenic element has a transverse dimension in excess of 0.4 m.

10. Cold box according to Claim 9, characterized in that the said main cryogenic element has a transverse dimension in excess of 1 m.

11. Air distillation installation, characterized in that it comprises at least one cold box according to any one of Claims 1 to 10.

12. Method for the on-site construction of a cold box according to any one of Claims 1 to 10, characterized in that:

- the cold box (1) is prefabricated in the form of a packet comprising roughly the entire cryogenic assembly (2) and the main part (20) of the outer jacket (3), some auxiliary parts (21) thereof being at least partially missing,
- the packet is transported,
- the cryogenic assembly (2) is completed as necessary,
- the outer jacket (20) is completed using its at least partially missing auxiliary parts (21), and
- each thermal insulator (4) is filled in between the outer jacket (3) and the cryogenic assembly (2).

13. Method according to Claim 12, characterized in that before transporting the packet, the outer jacket (3) is fitted with blanking panels (30) at the location of the at least partially missing auxiliary parts (21), and in that these blanking panels (30) are removed after transport and before the outer jacket (20) is completed using its at least partially missing auxiliary parts (21).

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Application No:	GB 0025569.5	**Examiner:**	Darren Handley
Claims searched:	1-13	**Date of search:**	30 May 2001

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): F4P (PBA, PFA)

Int Cl (Ed.7): F17C 1/12, 3/02, 13/00; F25J 3/00, 3/02, 3/04

Other: Online: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2334085 A	(L'AIR) - see figs. 3-5C and page 10, line 3- page 11, line 26.	1-3, 8, 11 at least
X	GB 2334084 A	(L'AIR) - see page 5, line 3- page 6, line 5, page 8, line 34- page 9, line 12 and page 12, lines 3-4	1-3, 9-11 at least
X	GB 2267958 A	(L'AIR) - see page 6, line 16- page 7, line 13.	1-3, 8-12 at least
X	US 5412954 A	(GRENIER) - see column 3, lines 26-56.	1-3, 8, 11 at least
X	US 5205042 A	(GRETER) - see fig. 1 and column 2, lines 31-42.	1-3, 8, 11 at least
X	FR 2776206 A	(L'AIR) - see figs. 6-8 and page 7, line 31- page 9, line 9.	1-3, 11 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.